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Short Communication

# Individual differences in pathogen disgust predict men's, but not women's, preferences for facial cues of weight

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ABSTRACT

Previous research suggests that people who score higher on measures of pathogen disgust demonstrate (1) stronger preferences for healthy individuals when assessing their facial attractiveness and (2) stronger negative attitudes about obese individuals. The relationship between pathogen disgust and attractiveness judgments of faces differing in cues of weight has yet to be investigated, however. Here we found that men's, but not women's, pathogen disgust was positively correlated with their preference for facial cues of lower weight. Moreover, this effect of pathogen disgust was independent of the possible effects of moral and sexual disgust. These data implicate pathogen disgust in individual differences in preferences for facial cues of weight, at least among men, and suggest that the sex-specific effects of pathogen disgust on preferences for facial cues of weight may be different to those previously reported for general negative attitudes about obese individuals.



## 1. Introduction

The importance of pathogens as a selective pressure for the human genome (Fumagalli et al., 2011) is thought to have shaped the evolution of two distinct aspects of the immune system (Fincher & Thornhill, 2012; Schaller, 2006): the classical immune system (i.e., physiological mechanisms of defense against parasites) and the behavioral immune system (i.e., psychology and behaviors for avoiding and managing infectious disease). Given the face's importance for social interaction, responses to facial cues may be an important aspect of the behavioral immune system. Indeed, people who are particularly concerned about infectious disease tend to show stronger aversions to facial cues thought to be associated with poor health (e.g., reduced sex-typical shape characteristics, Thornhill & Gangestad, 2006), particularly when assessing the attractiveness of potential mates (reviewed in Jones et al., 2013). These studies typically assessed individual differences in concerns about pathogens using the pathogen disgust subscale of the Three Domains of Disgust Scale (TDDS, Tybur, Lieberman, & Griskevicius, 2009). Experimentally priming concerns about pathogens strengthens preferences for putative cues of good health in potential mates (Little, DeBruine, & Jones, 2011), complementing correlational findings.

Other research into the behavioral immune system has focused on the stigmatization of obese individuals. For example, obese individuals elicit pathogen disgust in post-industrialized societies (Lieberman, Tybur, & Latner, 2011). Additionally, concerns about infectious disease are positively correlated with the strength of negative attitudes about obese individuals (Park, Schaller, & Crandall, 2007), particularly among women (Lieberman et al., 2011). People can judge others' weight from facial cues and tend to prefer faces displaying cues of relatively low weight (Coetzee, Perrett, & Stephen, 2009). Moreover, rated facial adiposity (the perception of heavier weight in the face) is correlated with measures of poor health, such as shorter lifespan (Reither, Hauser, & Swallen, 2009). Although facial attractiveness is correlated with immune system response in men (Rantala et al., 2012), but not women (Rantala et al., 2013a), rated facial adiposity is correlated with greater frequency of past illness in samples combining men and women (Coetzee et al., 2009) or including women only (Tinlin et al., 2013). Rated facial adiposity is also correlated with inefficient immune system response in men (Rantala et al., 2013b). Together, these findings raise the possibility that individual differences in pathogen disgust predict attractiveness judgments of faces differing in cues of weight.

Here we investigated the relationship between participants' responses on the pathogen, sexual, and moral disgust subscales of the TDDS and their attractiveness judgments of faces differing in cues of weight. Given previous research reporting correlations between face preferences and pathogen disgust (reviewed in Jones et al., 2013), we predicted that (1) participants who scored higher on the pathogen disgust subscale of the TDDS (i.e., participants

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who showed the greatest concern about infectious disease) would show the strongest aversions to individuals with relatively high levels of facial adiposity and (2) this effect of pathogen disgust would be independent of the possible effects of sexual or moral disgust. Lieberman et al.'s (2011) finding that women who score high on pathogen disgust hold particularly strong negative attitudes about obese individuals suggests that pathogen disgust may be a particularly good predictor of women's responses to facial cues of weight. However, Lee et al.'s (2013) finding that pathogen disgust more reliably predicts men's than women's preferences for putative health cues suggests that pathogen disgust may be a particularly good predictor of men's responses to facial cues of weight.

## 2. Methods

### 2.1. Participants

Sixty-two heterosexual couples (mean relationship duration = 18.4 months, SD = 15.1) participated in this study as part of an ongoing project investigating the relationship between mate preferences and choices. Other components of this project were unrelated to the current hypotheses and were randomly interspersed among the tests reported here (i.e., were unlikely to have systematically biased responses). Men's mean age was 21.8 years (SD = 1.96) and women's mean age was 21.2 years (SD = 1.94).

### 2.2. Stimuli

Stimuli were full-color images of 50 male (mean age = 24.2 years, SD = 3.99 years) and 50 female (mean age = 24.3 years, SD = 4.01 years) faces with neutral expressions and direct gaze. Images were taken under standardized lighting conditions, against a constant background, were standardized on pupil position, and masked so clothing was not visible. Height and weight measurements for these men (mean height = 180.2 cm, SD = 6.62 cm; mean weight = 77.3 kg, SD = 12.4 kg) and women (mean height = 168.6 cm, SD = 6.48 cm; mean weight = 57.2 kg, SD = 11.4 kg) were used to calculate their body mass index (BMI; men: $M = 23.7$ kg/m$^2$, SD = 3.13 kg/m$^2$, range = 17.7–31.0 kg/m$^2$; women: $M = 20.1$ kg/m$^2$, SD = 3.66 kg/m$^2$, range = 16.2–38.4 kg/m$^2$).

The male faces were rated for weight by 25 raters (15 women, 10 men; mean age = 22.54 years, SD = 5.05) in a randomized order using a one (very underweight) to seven (very overweight) scale (Cronbach's alpha = 0.96). A different group of 25 raters (23 women, 2 men; mean age = 24.11 years, SD = 6.94) rated the female faces for weight using the same method (Cronbach's alpha = 0.95). Average adiposity ratings for each face (male: $M = 3.83$, SD = 0.82; female: $M = 3.65$, SD = 0.88) were positively correlated with BMI (men: $r = 0.58$, $N = 50$, $p < 0.001$; women: $r = 0.66$, $N = 50$, $p < 0.001$).

### 2.3. Procedure

Participants in our main study rated the attractiveness of the 50 male and 50 female faces using a one (much less attractive than average) to seven (much more attractive than average) scale. Inter-rater agreement for these ratings was high (Cronbach's alpha for men rating women, men rating men, women rating women, and women rating men were all >0.90). Participants also completed the TDDS (Table 1). Responses on the three TDDS subscales were scored following Tybur et al. (2009). Higher scores represent greater disgust sensitivity. The TDDS and face ratings were completed in a fully randomized order. Male and female faces were presented in separate, randomly ordered blocks of trials in the face-rating task, and, within each block, trial order was fully randomized. The order of TDDS items was also fully randomized in the questionnaire block. As in previous research (Tybur, Bryan, Lieberman, Caldwell Hooper, & Merriman, 2011), women reported greater sexual ($t(61) = 7.10$, $p < 0.001$, $d = 0.90$) and pathogen ($t(61) = 2.20$, $p = 0.032$, $d = 0.28$) disgust than men. Women and men did not differ significantly in moral disgust ($t(61) = -0.23$, $p = 0.82$, $d = 0.03$). Partners' scores for sexual disgust were positively correlated ($r = 0.38$, $N = 62$, $p = 0.002$), but partners' scores for pathogen ($r = -0.01$, $N = 62$, $p = 0.95$) and moral ($r < 0.01$, $N = 62$, $p > 0.99$) disgust were not.

**Table 1**
Descriptive statistics for subscales of Tybur et al.'s (2009). Three Domains of Disgust Scale (TDDS).

| TDDS subscale | Female mean (SD) | Male mean (SD) |
|---|---|---|
| Sexual disgust | 19.16 (7.86) | 11.68 (7.00) |
| Pathogen disgust | 25.00 (8.50) | 21.66 (8.37) |
| Moral disgust | 28.18 (9.41) | 28.57 (9.01) |

## 3. Results

For each participant, we first calculated the correlation between (1) their attractiveness rating for each of the 50 men's faces and those 50 men's rated facial adiposity (mean $r = -0.14$, SD = 0.14), (2) their attractiveness rating for each of the 50 men's faces and those 50 men's BMI (mean $r = -0.09$, SD = 0.14), (3) their attractiveness rating for each of the 50 women's faces and those 50 women's rated facial adiposity (mean $r = -0.19$, SD = 0.13), and (4) their attractiveness rating for each of the 50 women's faces and those 50 women's BMI (mean $r = -0.24$, SD = 0.12). Note that this procedure produces four correlation coefficients for each participant (representing their preferences for perceived adiposity in male faces, cues of BMI in male faces, perceived adiposity in female faces, and cues of BMI in female faces, respectively). These preference scores (i.e., correlation coefficients) served as the dependent variables in subsequent analyses. For each of these preference scores, larger positive values indicate stronger preferences for facial cues of heavier weight and larger negative values indicate stronger preferences for facial cues of lower weight.

In order to establish whether preferences for rated adiposity and preferences for cues of BMI measure similar constructs, we analyzed men's and women's preference scores for own-sex and opposite-sex faces using factor analysis. Analysis of women's preferences for perceived adiposity and cues of BMI in opposite-sex faces produced a single factor (labeled *women's preference for cues of weight in men's faces*) that explained 88% of the variance in women's preference scores and was highly correlated with both of the original variables (both $r = 0.94$). A corresponding analysis of women's judgments of own-sex faces also produced a single factor (labeled *women's preference for cues of weight in women's faces*) that explained 83% of the variance in women's preference scores and was highly correlated with both of the original variables (both $r = 0.91$). Similar factor analyses were conducted for men's face preferences. Analysis of men's preferences for perceived adiposity and cues of BMI in opposite-sex faces produced a single factor (labeled *men's preference for cues of weight in women's faces*) that explained 86% of the variance in men's preference scores and was highly correlated with both of the original variables (both $r = 0.93$). A corresponding analysis of men's judgments of own-sex faces also produced a single factor (labeled *men's preference for cues of weight in men's faces*) that explained 86% of the variance in men's preference scores and was highly correlated with both of the original variables (both $r = 0.93$). These preference

scores were used in our main analyses. Higher scores indicate stronger preferences for facial characteristics associated with heavier weight.

To test for main effects of TDDS subscales and possible interactions between TDDS subscales and sex of face judged, responses were analyzed using ANCOVAs. Women's preferences for cues of weight in men's and women's faces were analyzed first. *Sex of face judged* (male, female) was a within-subject factor and *pathogen disgust*, *sexual disgust*, and *moral disgust* were entered simultaneously as covariates. This analysis revealed no significant effects (all $F < 1.33$, all $p > 0.25$, all partial $\eta^2 < 0.023$). However, a corresponding analysis for men's preferences revealed significant effects of *pathogen disgust* ($F(1,58) = 5.99$, $p = 0.017$, partial $\eta^2 = 0.094$) and *moral disgust* ($F(1,58) = 5.73$, $p = 0.020$, partial $\eta^2 = 0.090$). There were no other significant effects (all $F < 1.28$, all $p > 0.26$, all partial $\eta^2 < 0.021$).

To interpret the main effects of *pathogen disgust* and *moral disgust* on men's preferences we conducted a regression analysis, in which the average of *men's preference for cues of weight in women's faces* and *men's preference for cues of weight in men's faces* was entered as the dependent variable and *pathogen disgust* and *moral disgust* were entered simultaneously as predictors. This analysis revealed a significant negative relationship between *pathogen disgust* and men's preference for cues of weight ($t = -2.52$, standardized $\beta = -0.35$, $p = 0.014$) and a significant positive relationship between *moral disgust* and men's preference for cues of weight ($t = 2.43$, standardized $\beta = 0.34$, $p = 0.018$). Including *sexual disgust* as an additional predictor in this regression analysis did not alter the pattern of results.

An additional, custom model ANCOVA that included data from both male and female participants revealed a significant interaction between *participant sex* (male, female) and *pathogen disgust* ($F(1,116) = 5.96$, $p = 0.016$, partial $\eta^2 = 0.049$), confirming that pathogen disgust had different effects on men's and women's face preferences. The interactions between *participant sex* and *sexual disgust* and *moral disgust* were not significant, however (all $F < 1.60$, all $p > 0.20$, all partial $\eta^2 < 0.015$).

## 4. Discussion

Men with higher pathogen disgust showed stronger preferences for facial cues of lower weight, complementing other recent research suggesting pathogen disgust predicts men's responses to facial cues of health (e.g., Jones et al., 2013; Lee et al., 2013). The effect of pathogen disgust on men's face preferences was independent of possible effects of moral and sexual disgust, revealing a domain-specific effect of disgust sensitivity on preferences for facial cues of weight. Although previous work found that pathogen disgust was a particularly good predictor of women's responses to obese individuals (Lieberman et al., 2011), pathogen disgust did not predict women's facial attractiveness judgments in our study. That pathogen disgust here predicted men's, but not women's, preferences for cues of weight is consistent with Lee et al.'s (2013) finding that pathogen disgust may be a more reliable predictor of men's than women's preferences for putative health cues. Further research is needed to establish why (and when) this sex-specific pattern of results may emerge.

The different patterns of results in our and Lieberman et al.'s (2011) studies could reflect differences in the nature of the attitudes to heavier individuals that were assessed. While Lieberman et al. (2011) examined participants' responses on questionnaires assessing individual differences in general social attitudes to obese individuals, our study examined attractiveness judgments of face photographs. Although other methodological differences may also contribute to the different patterns of results observed in our and Lieberman et al's studies, the different patterns suggest that pathogen disgust may have somewhat different effects on general social attitudes and face preferences. If this were the case, it would complement other recent work suggesting that ratings of facial attractiveness and perceptions of general social regard are not necessarily synonymous (e.g., Sutherland et al., 2013).

Although it was not an *a priori* prediction of our study, men who scored higher on moral disgust showed weaker preferences for cues of low weight. Moreover, this effect of moral disgust was independent of the observed effect of pathogen disgust on men's face preferences. One possible explanation for this unexpected finding is that men who score higher on moral disgust generally hold weaker appearance-based stereotypes. Further work is needed to explore this possibility.

We found that men, but not women, who scored higher on pathogen disgust showed stronger aversions to faces displaying cues of heavier weight (i.e., individuals displaying higher levels of facial adiposity). This result complements other recent research linking pathogen disgust to face preferences (reviewed in Jones et al., 2013) and implicates pathogen disgust in individual differences in preferences for facial cues of weight, at least among men. Although other studies also suggest that pathogen disgust may be a particularly reliable predictor of men's preferences for facial cues of health (Lee et al., 2013), the sex-specificity of our findings is somewhat surprising, given Lieberman et al.'s (2011) work suggesting that pathogen disgust is a particularly good predictor of women's negative attitudes towards obese individuals. Nonetheless, together, these findings suggest that the sex-specific effects of pathogen disgust on preferences for facial cues of weight may be different to those that occur for general negative attitudes about obese individuals.

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